Fully normal upon all points, its individuality is yet shown in the uniformity and large size of tubercle I on all abdominal segments. This is about three times the size of a spiracle and equals IV, ordinarily the largest general plate. On joint ten, the evanescent IVa becomes the largest lateral plate of the five here surrounding the spiracle. The anal plate is normal, brown.

Last stage: More of the early colouring is retained at this time than usual, the dull pinkish ground colour giving definition to the pale yellowish lines, which remain as before. Head shining brown, with blackish shade at ocelli; width, 3.25 mm. Body robust smooth, cylindric, livid; setae weak. Onjoint one the cervical shield is wider than head and is margined with black laterally. On joints four, five and six tubercle I is reduced; on ten the same arrangement holds as formerly, and all tubercles are indicated by blackish plates. The spiracle on joint eleven is not enlarged, as it is with the fern feeders. Lengths, 52 and 56 mm. for the stages respectively.

The pupa is correspondingly robust, shining brown and active; there is no frontal development and the cremaster consists of two separate and slightly divergent, curved hooks. The transformation is made in the ground after a rather lethargic resting period, the date of leaving the burrow being from Aug. 10 to 25, so far as could be determined.

A Tachinid fly claimed a large percentage of the observed larvæ, and doubtless is a regular check in this case, as with others. It seems to be, according to Dr. J. M. Aldrich, *Masicera seniles* Ms.

With the full evidence at hand there is no question as to the standing of this as a distinct species. There is, however, the question yet open as to what one of the species Guenee's type of *rutila* may finally fit in with. Drawings of that type indicate a narrow winged, yellow form, with brightly white stigmata, and there seems no fear of duplication in the case of *aralix*. Serial position near *merriccata* and *arctivorens* may be accorded it.

Our specimens of *araliae* were collected in the woodlands bordering the DuPont Bouvelard, beginning about two miles south of Ellendale, thence southward wherever the foodplant occurs in abundance, for a distance of about fifteen miles. The wide southern and western distribution of the foodplant (Pennsylvania to Florida and Texas) makes it probable that the associated insect, may also prove to be a widely distributed species with a range possibly approximately that of the plant.

Explanation of Plate vi.

Fig. 1—*Papaipema araliae*, penultimate stage larva.
2—*Papaipema araliae*, mature larva.
3—*Papaipema araliae*, male.
4—*Papaipema araliae*, female.

A REVISION OF THE CANADIAN SPECIES OF THE AFFINIS GROUP OF THE GENUS TABANUS (DIPTERA).

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In connection with the preparation of a complete list of Canadian species of the genus *Tabanus* it became necessary to revise thoroughly the existing iden-

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tifications in the Canadian National Collection. It soon was evident that in the *affinis* group, which is essentially a northern one, there were a number of closely allied forms, capable apparently of separation on structural details of palpi, antennae, etc., which heretofore had been lumped under a single specific name.

In anticipation of a more extended work on the entire genus and with a view to clearing up the various nomenclatorial tangles in the group, I offer the following notes on the various Canadian species, accompanied by a key, based on a study of the structural characters of the females only. Owing to the relative scarcity of the males and the difficulty of definitely associating them with the correct females I am unable at the present time to give satisfactory characters for this sex. I have been in constant correspondence with Prof. Jas. Hine in regard to the correct application of many of our older names and I am pleased to state that in every instance we agree as to the species to which such names should be applied. Miss G. Ricardo has also compared for me a good deal of material with Walker's types in the British Museum and thus enabled me to definitely place several of his heretofore unrecognized species. To both these workers my hearty thanks is due. I am also greatly indebted to Mr. E. P. Vanduzee, San Francisco, Calif., Prof. A. L. Lovett, Corvallis, Oreg., Prof. R. A. Cooley, Bozeman, Mont. and Mr. J. B. Wallis, Winnipeg, Man. for loan of material.

The *affinis* group, as understood in the present paper, comprises those species in which the greater part of the first four abdominal segments is red or orange-red of various shades with a varyingly broad blackish dorsal band. The species extend across the entire northern half of the American continent reaching southward along the Atlantic Coast, down the Rocky Mountains and through the Cascades to the Sierra Nevada Mts. Further collection, especially in British Columbia will probably increase the number of known species; at the present time I am able to differentiate thirteen species.

Key to Species.

FEMALES.

1. Abdomen with 1st segment laterally orange or reddish.....2
   Abdomen with 1st segment laterally black.....12
2. Wings with all cross-veins distinctly clouded with brown .....*lasiophthalmus* Macq.
   Wings unclouded or with only bifurcation of third vein clouded.....3
3. Palpi thin, not swollen at base of 2nd joint.....4
   Palpi shorter, with base of 2nd joint noticeably thickened.....9
4. Subcallus normally denuded; front very broad.....*captonis* Mart.
   Subcallus normally not denuded.....5
5. Small species, 10 mm., very thin palpi, antennae with 3rd joint scarcely excavated basally.....*minusculus* Hine.
   Larger species, 14mm., or over.....6
6. Large species, 17-19mm; antennae with 3rd joint very strongly excavated basally 7
   Smaller species, 14-17mm; antennae only moderately excavated at base..8
7. Palpi deep orange-yellow; abdomen laterally deep orange-red..*affinis* Kby

Palpi paler; abdomen laterally yellow-brown.....*californicus* Mart.

8. Palpi long and thin, deep orange; length 14-15mm.; basal portion of third antennal joint chunky.....*trepidus* McD.
   Palpi shorter and thicker, pale creamy; length 15-17mm.; basal portion of 3rd antennal joint rather slender.....*haemaphorus* Mart.
9. Subcallus normally denuded; palpi chunky, pale creamy.....*nudus* McD.
   Subcallus not normally denuded.....10
10. Antennae red with third joint moderately excavated; front narrow and coarctate; palpi moderately swollen.....*epistates* O. S.
    Antennae black with 3rd joint narrow and not noticeably excavated; front moderately broad; anterior branch of vein 3 frequently with basal stump 11
11. Wings with bifurcation of 3rd vein clouded with brown...*sonomensis* O. S.
    Wings with no cloud on bifurcation of third vein.....*phaenops* O. S.
12. Subcallus denuded, small species, 13mm.....*rupestris* McD.
    Subcallus not denuded, larger species, 16mm.....*atrobasis* McD.

Tabanus affinis Kirby. This is the largest species in the group and apart from size is best recognized by its long thin palpi of a deep orange color and the strong dorsal excavation at the base of the third antennal joint. It extends completely across the Dominion of Canada and in the East at least is not liable to be confused with any other species. In British Columbia it is rather rare and the following species, as well as *haemaphorus* Mart., have masquaraded under this name. According to Miss Ricardo triligatus Walk. is a sure synonym.

Tabanus californicus Marten. This name has been sunk as a synonym of *epistates* O. S. by Hine (1904, Ohio Nat. V, 236). Marten's types are unfortunately not in existence but on account of the size mentioned in the original description (17mm.) and the fact that it is very doubtful if the true *epistates* occurs as far south as California, I am inclined to associate this name with a large Pacific Coast form closely allied structurally with *affinis* but differing very decidedly in the lateral coloration of the abdomen. In *affinis* the color is a rather rich orange-red whilst in the present species it is yellow-brown, shaded with lighter yellow along the segmental margins. I have seen two specimens from Oregon and the Canadian National Collection contains a series of six females taken by Dr. S. Hadwen at Mt. Lehman in the Lower Fraser Valley, B. C. Marten's original description particularly mentions this yellow-brown color and the remainder of his description fits in so satisfactorily with the present species that I have adopted the name without much hesitation.

Tabanus haemorphorus Marten. Hine has sunk this name as a synonym of *sonomensis* O. S. but I cannot accept this. The true *sonomensis* is a comparatively small species, whereas the size of *haemaphorus* is given by Marten as 16-18mm. What I consider to be this species has been generally passing under the name of *affinis* Kby. It is apparently the commonest British Columbia species, occurring in May and June and differs from the true *affinis* in the shorter and paler colored palpi and the less excised 3rd antennal joint; it is also somewhat more slender in build. Besides the British Columbia series in the National Collection I have seen specimens from Oregon.

Tabanus captonis Marten. I agree with Hine's identification of this species,

with *comastes* Will. as a synonym. As stated (1904, Ohio Nat. V, 235) the species is readily separated by its wide front and denuded subcallus.

The species is quite common on Vancouver Island and on the mainland of British Columbia in the Lower Fraser Valley.

Tabanus lasiophthalmus Macquart. This is the only species of the group in which all the cross-veins of the wings are decidedly tinged with brown, which renders identification quite easy; other features are the denuded subcallus and the presence of pale yellowish oblique stripes laterally on the reddish areas of abdomen. It is just possible that occasional specimens occur in which the usual maculation of the wings is absent; one or two specimens before me which lack such maculation seem in all other respects to agree with normal specimens of *lasiophthalmus*. The species extends across the entire continent.

Tabanus trepidus, sp. nov. ♀, Palpi long, thin, not swollen at base and tapering to a fine point, deep yellow-orange, rather heavily clothed with black hairs; antennae reddish, the dorsal and terminal portion of 3rd. segment blackish; 3rd segment rather chunky and only moderately excised dorsally at base; subcallus not denuded; front dull yellowish, moderately broad with callosity and a spindle shaped patch above it shiny black; thorax dull blackish with the usual pale obsolescent stripes and the antealer tubercles slightly tinged with reddish; abdomen much as in lasiophthalmus with lateral areas of first four segments broadly reddish-orange, with distinct traces of pale oblique yellow stripes, and with a black dorsal band, widest on 1st segment; ventrally yellow-orange, more or less shaded with smoky, terminal segments blackish; legs blackish, the proximal half of all tibiae tinged with orange-yellow; wings dull hyaline, costal cell and area surrounding longitudinal veins in basal half of wing tinged with brown.

Length 14-15mm.

Holotype. 1♀, Ottawa, Ont. (June 26th., W. Metcalfe) in Canadian National Collection.

Paratypes. Numerous ♀'s from Shelburne, N. S. (July 1st., A. Gibson); Harcourt, N. B.; Ottawa, Ont.; Ft. Coulonge, Que.; Aweme, Man. and Peachland, B. C., in Canadian National Collection.

The species has been frequently confused with *epistates* O. S., but can at once be differentiated by the long thin palpi; from *affinis* it differs in its smaller size and less excavated third joint of the antennae.

Tabanus minusculus Hine. A single specimen of this small species is in the Canadian National Collection, kindly identified for me by Prof. J. Hine; it was captured at Ottawa, (Mer bleue, 26th., June, 1904) by Mr. W. Metcalfe. The palpi are extremely thin and the antennae show scarcely any excision of the basal portion of the 3rd joint. The subcallus is covered with a fine ochreous pollen and the callosity is brownish, extending up the front as a thin black line to the ocelligerous tubercle which is also brown.

Tabanus epistates O. S. Several species have been confused under this name which would account for Hine's statement in his paper on Western Tabanidae (1904, Ohio Nat. V, 236). Osten Sacken's characterization is so clear, however, as to leave no doubt in any mind as to the species to which the name should be applied. The narrow coarctate front is quite characteristic; the palpi are moderately long, pale ochreous and distinctly swollen at the base, the subcallus

is not denuded and the antennae are generally almost entirely red with base of 3rd joint rather chunky and moderately excised. The pale oblique stripes on the abdomen, noted in *lasiophthalmus* and allied species, are not present in *epistates*. The species appears to be common throughout Manitoba Saskatchewan, and the Hudson Bay region, rather rare in Ontario, Quebec and New Brunswick and decidedly rare in British Columbia; the only two specimens from this latter region which I should incline to place under this name were captured at Vernon and Cranbrook; both are rather larger than normal and have the antennae more suffused with black than is generally the case.

Tabanus nudus, sp. nov. This species has been so generally confused with *epistates* that a comparative description, indicating the points of distinction, is all that is necessary. The front is distinctly broader and the subcallus is denuded; the palpi are shorter and basally more swollen; the antennae are blacker apically, the basal portion of the 3rd joint is rather wider and the finger-like dorsal projection of the 2nd joint is much longer. The pale yellow lateral oblique stripes on the abdomen are present and only slightly less distinct than in *lasiophthalmus*. Length 15mm.

Holotype. 1♀, Ottawa (Mer bleue, June 1st., 1908), in Canadian National Collection.

Paratypes. Numerous ♀'s from New Brunswick (Fredericton, St. Stephen); Ontario, (Ottawa, Hastings Co.,); Manitoba, (Aweme); Saskatchewan and British Columbia. (Mt. Lehman).

The species is much commoner and more wide-spread than *epistates*.

Tabanus sonomensis O. S. The true *sonomensis* is a rather small species, confined, as far as I know, entirely to the Pacific Coast region. The British Columbia records I possess for the species are all from Vancouver Island but it probably will be found in the Lower Fraser Valley as well. Apart from its smaller size it may be distinguished from the preceding species by the entirely black antennae with a narrow thirdjoint, scarcely excised at base. There is a decided tendency towards a stump at the base of the anterior branch of the 3rd vein, the cross-vein being generally decidedly tinged with brown. Hine (1904, Ohio Nat. V, 244) has treated several forms under the name *sonomensis* but his remarks in the first paragraph are applicable to the true species.

Tabanus phaenops O. S. The species is very closely allied to the preceding and I have not yet decided to my entire satisfaction whether the two can go definitely separated. Typical phaenops possesses almost blackish palpi in contradistinction to the pale ochreous ones of *sonomensis* but this character seems variable; Oregon specimens and ones from Laggan, Alta., which agree in other respects, have pale palpi. The lack of the brown spot on the cross-vein seems more characteristic and for the present I am using this feature to separate the two forms. The antennae are similar to those of *sonomensis* and the reddish area of the abdomen seems variable in its extent. The species is decidedly rare in Canada and more material will be necessary to definitely decide its status.

Tabanus rupestris, sp. nov. ♀. Palpi moderately long, very little swollen at bsae, dull orange, at times considerably tinged with smoky; antennae thin, reddish, the distal half of 3rd joint black, very slight excavation dorsally at base of 3rd joint; subcallus denuded, shiny black; callosity shiny black with wedge-shaped black patch above it; front with yellowish pollen and black ocelligerous tubercle;

thorax blackish with the usual faint, pale lines; antealar tubercle black; abdomen dorsally with 1st segment almost entirely black, slight traces of orange being visible on the extreme lateral posterior area; a broad (2mm.) black dorsal band crosses segments II-IV, the lateral areas being deep orange-red, remaining segments black; slight traces of a paler flesh-colored oblique stripe on the red area of segment II; ventrally orange-red the posterior border of the 1st segment and the last three segments blackish; legs with all femora black, anterior tibiae tinged with orange proximally, other tibiae entirely dull orange; wings hyaline with costal cell brownish and a faint brown cloud at the base of the anterior branch of 3rd vein. Length 14mm.

Holotype. 1♀, Gallatin Co., Montana (July 14th., 7500 ft) in Canadian National Collection.

Paratypes. 2♀'s, Gallatin Co., Montana (July 27th., 5500 ft.) in Collection of Montana Agr. Coll.; Cowley, Alta. (Sept., R. N. Chrystal) in Canadian National Collection.

The species closely resembles *phaenops* but differs in the denuded subcallus, the redder antennae, the broader black area on 1st abdominal segment and the cloud on the outer cross-vein; none of the specimens before me shows any trace of a stump at the base of the anterior branch of vein 3 as is so often seen in phaenops; the extent of the black area on the first segment may be variable and should not be too much relied on as a sole means of separation from *phaenops.*

Tabanus atrobasis, sp. nov. ♀. Palpi orange, heavily clothed with short black hair, not swollen at base; antennae black with 2nd joint and basal portion of 3rd red; dorsal angle at base of 3rd joint obtuse, with little excavation, this whole portion being rather slender; subcallus and front covered with pale yellowish pollen, latter moderately (.5-.75mm.) broad with shiny black-brown callosity extended towards as usual by a fine black line; thorax blackish with the five pale lines as usual and a black antealar tubercle; abdomen with first segment dorsally entirely black except a very narrow line of orange along posterior margin; second to fourth segments laterally orange, shaped somewhat with brownish; a broad (2mm.), black, dorsal band with more or less distinct central row of triangular pale spots situated on rear margin of segments and clothed with pale yellowish hair; last three segments blackish; rear margins of all segments with yellow hair; ventrally dull orange, shaded with smoky and with rear segments entirely black. Legs black, anterior tibiae slightly, other tibiae almost entirely dull-orange.

Length 16-17 mm.

Holotype. 1♀, Mt. Lehman, B. C. (May 30th., S. Hadwen) in Canadian National Collection.

Paratypes. Numerous ♀'s from various B. C. localities (Mt. Lehman, Victoria, Duncan, Courtenay, Royal Oak) in Canadian National Collection.

The species has apparently been confused with both *sonomensis* and *captonis;* the entirely black first abdominal segment seems quite characteristic and separates *atrobasis* from both the above mentioned forms; it is considerably larger than *sonomensis* and lacks the denuded subcallus and chunky third antennal joint of *captonis.* The species extends south into Oregon, a number of specimens having been received from Prof. Lovett, labelled either *sonomensis* or *epistates.*